Chapter 8 – CONCEPTUAL DESIGN OF THE PREFERRED ALTERNATIVES

8.1 Introduction

The previous chapters of this FS report provide a description of the processes, which have been used to select appropriate remedial alternatives. Chapter 2 defines the objectives of the cleanup action (RAOs). Chapter 3 identifies the soil volumes, which require treatment. Chapter 4 identifies applicable technologies and process options, which can effectively treat the soils to meet the RAOs. Chapter 5 presents the findings of treatability studies performed on Site soil to better define the applicability of various technologies. Chapters 6 and 7 evaluate and compare alternatives and select a preferred alternative that can be used to cleanup the Site.

This section describes how the Site cleanup can be achieved using the preferred alternatives. Section 8.2 describes how the preferred alternative will be used in each RU to achieve cleanup goals. Section 8.3 describes the alternative to be used for Miscellaneous Small RUs. Section 8.4 summarizes an estimate of the total remediation cost for the entire Site.

8.2 Conceptual Design by Remediation Unit (Large Scale Applications)

This section describes the preferred alternatives and how they may be applied to each remediation unit.

Golf Course RUs: Golf Course RUs are defined by the property inside the golf course footprint, other than Miscellaneous Small Units. They consist of the following four sub-units:

- Golf Course Placement/Deposition Areas (PA): These are discrete areas within the golf course footprint that will be used to deposit soils from other RUs. Each PA will be capped with the Cap/Cover described in Section 7.2.3. No excavation is planned in these areas unless soils occur that that have arsenic or lead concentrations above the golf course remediation levels (i.e., 530 mg/kg for arsenic and 4,100 mg/kg for lead). These soils will be treated as “Hot Spots” as described in Section 8.3.
- Non-PA Areas within Golf Course RUs: This is the property within the Golf Course RUs that is not a PA. Soils in these areas will be excavated and placed within the PAs. Following the excavation of these soils, the resulting surface soils will be sampled (i.e., 5-point composite samples collected on a 75 foot grid) and if found to be above the golf course remediation level, re-excavated. In the unlikely event that confirmation sampling identifies soils that have arsenic or lead concentrations above the golf course remediation levels, they will be treated as “Hot Spots” as described in Section 8.3.
- Foundations within Golf Course RUs: Foundations of the former manufacturing building remain within the non-PA areas of the golf course. Elevated levels of lead contamination can occur in the vicinity of these foundations if the buildings were lined with lead sheeting or were either painted with or stored lead-based paint. The lead concentrations decrease significantly with increased distance from the foundation. As such, an excavation limit of 25 feet from the foundation wall will be used. No excavation will be done outside the 25-foot excavation limit. An excavator will be used to complete all the planned work. No bulldozers or scrapers will be used to excavate these soils. Excavated soils will be hauled by truck. All excavated soils will be placed in a PA **if their concentrations do not exceed golf course remediation levels**. In the unlikely event that confirmation sampling identifies soils that have arsenic or lead concentrations above the golf course remediation levels (i.e., 530 mg/kg for arsenic and 4,100 mg/kg for lead), these soils will be treated as “Hot Spots” as described in Section 8.3. Water will be used within the work area and on haul roads to control dust. All decisions on the need for further excavation will be based upon a “pass/fail” system in which if a sample exceeds screening concentrations the excavation will be deepened. No statistics will be used. Excavation and sampling will

continue until cleanup goals are met. Foundations that are located within placement areas will not be excavated.

- NGRR within Golf Course RUs: NGRR sections occur within the GC land use area. Past sampling determined that soils within 25 feet of NGRR centerlines can contain elevated arsenic concentrations. All soils within the 25 feet the NGRR centerline will be excavated to a depth of 1.5 feet. The sides of the rail bed will be excavated first, followed by the rail bed itself. The excavated soil will be hauled, by truck, to the nearest placement area and deposited unless, in the unlikely event that confirmation sampling identifies soils that have arsenic concentrations above the golf course remediation levels (i.e., 530 mg/kg for arsenic). These soils will be treated as "Hot Spots" as described in Section 8.3. Water will be used within the work area and on haul roads to control dust. All decisions on the need for further excavation will be based upon a "pass/fail" system in which if a sample exceeds screening concentrations the excavation will be deepened. No statistics will be used. Excavation and sampling will continue until cleanup goals are met. NGRR tracks that are located in PAs will not be excavated.

Open Space RUs: Open Space RUs consist of all Site property that will be left in its current condition. There are four open space RUs on-Site. Sequalitchew Creek NGRR has been excluded and will be considered a Miscellaneous Small Unit. They are Sequalitchew Creek Canyon (OS-01), open space north of Sequalitchew Creek (OS-02 NOC), open space south of Sequalitchew Creek (OS-3 SOC) and Old Fort Lake (OS-03).

The OS-1 RU is adjacent (i.e., south of) to Sequalitchew Creek. There are three locations where the lead concentrations exceed the ecological screening level and these three locations are classified as Miscellaneous Small Units (MSUs) and will be excavated.

There are several locations in OS-2 and OS-3 RUs where the arsenic or lead concentrations exceed the open space cleanup or remediation levels. These exceedances (including the former LR-68 hot spot which is the only location where remediation will occur on a side hill) are associated with former roads, hot spots, or are included in the Sequalitchew Creek NGRR MSUs.

The OS-4 RU is the open space surrounding Old Fort Lake. There are no lead exceedances, but there are four locations that have arsenic concentrations marginally above the area background concentration of 32 mg/kg.

No Action (other than MSU excavation) is proposed for Open Space RUs due to their special ecological sensitivity. The justification for this proposal is centered on the following five factors:

- Habitat: These RUs consist of vibrant ecological communities. Such habitat is important to the local ecosystem considering the amount of habitat that will be eliminated due to the remediation of all areas surrounding them.
- Low Contaminant Concentrations: Contaminant concentrations in these areas are low, with few locations where the Site-specific human health CLs are exceeded.
- Proximity to surface water: These RUs contain or are located within 100 feet of a surface water body. As such, excavation in these areas could cause significant impact, such as slope instability and potential sedimentation.
- Topography: These RUs have steep topological conditions. As such, containment of runoff from excavation activities could be problematic.
- Accessibility: Due to the steep topography, human exposure in these RUs will be limited to established travel routes.

Commercial RUs: Commercial RUs are defined by the property inside the Site that is planned for commercial land use applications, other than Miscellaneous Small Units. Soils in these RUs will be

excavated to a depth of 1.0 foot, and placed within the Golf Course land use PAs. Following the excavation of these soils, the resulting surface soils will be sampled, (i.e., 5-point composite samples collected on a 75 foot grid) and if found to be above the remediation level for the golf course land use, re-excavated. In the unlikely event that confirmation sampling identifies soils that have arsenic or lead concentrations above the golf course land use RLs, they will be treated as "Hot Spots" as described in Section 8.3.

Historical RUs: These RUs make up the areas of the Site that have historic significance, as defined by a listing with the Office of Archaeology and Historic Preservation. At this time three historical RUs are known to exist on-Site. They are:

- Fort Nisqually Cemetery: (45PI404)
- Shell Midden: (45PI72)
- 1833 Fort Nisqually Site (45PI55)
- Each of these areas are small in size (less than 2 acres) and could contain discrete locations where arsenic or lead concentrations above the Site-specific remediation levels (i.e., 60 mg/kg for arsenic and 118 mg/kg for lead) occur. As such, these RUs and/or the discrete areas they contain will be treated as either "small-scale applications" or "Hot Spots" as described in Section 8.3. Mass excavation will not be done in these RUs.

8.3 Conceptual Design (Small-Scale Applications and Miscellaneous Small RUs)

The selected remedy for each historical RU will be protective of human health and the environment and will be dependent on how the land is going to be used in the future. A different remedy may be selected for an area depending on who is going to use the land (e.g., children versus adults). Stakeholders' concerns regarding the cultural resources associated with each historical RU will also be a consideration in the remedy selection process. For example, based on cultural resource concerns, capping may be appropriate for one site (e.g., Fort Nisqually Cemetery) and inappropriate for another (e.g., Shell Midden).

The selection of the preferred alternative for these RUs was performed in Chapter 7. This section summarizes how each alternative will be applied to each remediation unit.

Historical RUs: Each of these areas are small in size (less than 2 acres) and could contain discrete locations where arsenic or lead concentrations above the Site-specific remediation levels (i.e., 60 mg/kg for arsenic and 118 mg/kg for lead). As such, these RUs and/or the discrete areas qualify as either a "small-scale application" or a "Hot Spot." They are:

- Fort Nisqually Cemetery (45PI404);
- Shell Midden (45PI72); and
- 1833 Fort Nisqually Site (45PI55).

RI and other characterization data show that discrete locations within the boundary of these RUs contain lead concentrations greater than CLs. These sites are of important historical significance and should be left undisturbed to the highest degree possible. To do this, no excavation will take place, and a Cap/Cover (as described in Section 7.6.5) will be installed over the contaminated soils to prevent direct contact. A deed restriction, prohibiting excavation in the areas covered by the Cap/Cover, will be necessary to ensure the long-term effectiveness of the Cap/Cover.

Golf Course Land Use RUs: No excavation will occur unless Site-specific RLs are exceeded. Soils with contaminant concentrations exceeding RLs are considered miscellaneous small remediation unit "Hot Spots" and will be remedied by the methods described in the following section.

Miscellaneous Small Remediation Units: Miscellaneous Small Remediation Units are defined as soils impacted by contaminants or contaminant mixtures that have an in-situ volume believed to be smaller than 5,000 CY. This volume was determined to be the limit below which extensive evaluation of remedial

alternatives or implementation of specialized on-Site treatment technologies would not be cost effective. Appendix G presents the procedures and assumptions used in defining the "small" remediation units.

- Similar mixture of contaminants: Soils above Site-specific CLs or RLs would be excavated, loaded, and hauled to an off-Site landfill for disposal, using 30-ton trucks.
- Similar deposition method: Soils above Site-specific CLs or RLs would be excavated, loaded, and hauled to an off-Site landfill for disposal, using 30-ton trucks.
- Small occurrence(s) of a single contaminant: The preferred alternatives for these MSUs is Excavation and Off-Site Disposal, where soils with selected contaminant concentrations above Site-specific CLs or RLs would be excavated, loaded, and hauled to an off-Site landfill for disposal, using 30-ton trucks, and No Action. No action would be appropriate for small occurrences of cadmium which has not been detected in groundwater, occurs in very low concentrations, has an average/mean concentration below the cleanup level, has a low number of exceedances (less than 5%) of the cleanup level in comparison to the number of detections and/or samples collected, and has no known source associated with activities at the Site.
- Contamination "hot spots" discovered during final cleanup: Soils above Site-specific CLs or RLs would be excavated, loaded, and hauled to an off-Site landfill for disposal, using 30-ton trucks.
- Debris: Debris with contaminant concentrations above Site-specific CLs or RLs would be excavated, loaded, and hauled to an off-Site landfill, using 30-ton trucks.
- Sequalitchew Creek NGRR: This RU is represented by the linear length of the track and the width of track bed from the toe of the uphill slope and the crest of the downhill slope. Soil with contaminant concentrations above Site-specific CLs or RLs would be excavated, loaded, and hauled to an off-Site landfill, using 30-ton trucks. The remainder of the track bed will be covered with a gravel subbase and capped with asphalt. This Cap will act as an exposure barrier to both human and ecological receptors.

8.4 Groundwater

Natural Restoration has been selected as the preferred alternative for the remediation of residual DNT in groundwater. Groundwater monitoring would be required on an annual basis until the monitoring wells reach compliance (represented by four consecutive sampling rounds showing DNT concentrations in the groundwater represented by that well are below the drinking water standard of 0.13 µg/L). Once this has been achieved the well will be closed by the proper methods (Chapter 18.104 RCW; Chapter 173-160 WAC) after approval from Ecology. Sampling of the remaining wells will continue until they reach compliance. Seep 1 will be sampled during the annual groundwater monitoring event after the surface soil mass excavation remediation work has been completed.

The highest DNT concentration in groundwater ever detected at the Site was 3.8 ug/L in MW-27 in January of 1995. If any of the results from future groundwater sampling is greater than 3.8 ug/L Weyerhaeuser and DuPont will meet with Ecology to discuss the results.

8.5 Estimate of Total Site Remediation Cost

The estimate of cost for the preferred alternative in this FS is based upon the application of the large-scale alternative (On-Site Deposition with Cap/Cover) for the majority of the Site and a combination of small-scale alternatives for small-scale and Miscellaneous Small RUs. The preferred alternative for each RU or small unit is summarized below:

Remediation Unit Type:	***Preferred Alternative***
Large Scale Applications	
Golf Course Land Use RUs	On-Site Deposition with Cap/Cover
Commercial RUs	On-Site Deposition with Cap/Cover
Open Space RUs	No Action

Small Scale Applications	
Historical RUs	Cap or Cap/Cover, On-Site Deposition with Cap/Cover
Golf Course Fill Areas	Cap or Cap/Cover
Small Miscellaneous RUs	
Similar mixture of contaminants	Off-Site Disposal at a Landfill
Similar deposition method:	Off-Site Disposal at a Landfill
Small occurrence(s) of a single contaminant	Off-Site Disposal at a Landfill, No Action
Contamination "hot spots" discovered during final cleanup	Off-Site Disposal at a Landfill
Debris (contaminated)	Off-Site Disposal at a Landfill
Sequalitchew Creek NGRR	Off-Site Disposal at a Landfill of "Hot Spots" and Cap (with asphalt) of NGRR track bed
Groundwater	
Site Wide	Natural Restoration

8.5.1 Cost for Remediation: Preferred Alternative – Large and Small Scale Applications

The costs for remediation of both large scale (the golf course land use RUs (excluding fill areas), commercial RUs and open space RUs) and small scale applications (Historical RUs, Golf Course Land Use fill areas and Miscellaneous Small RUs) are presented in Table 8 -1.

8.5.2 Cost of Groundwater Remediation

The cost for total Site remediation is approximately $ 9,000.00 per year. For this FS a 10-year period is estimated bringing the total to $ 90,000.00.

8.5.3 Cost for Total Site Remediation

The cost for total Site remediation, for the preferred alternatives, is presented in Table 8-2.

Table 8-1 – Summary of Remediation Costs: Preferred Alternative – Large and Small Scale Applications

Estimated Low and High Remediation Costs for Large Scale Applications

PREFERRED ALTERNATIVE:	LOW RANGE TOTAL COST	HIGH RANGE TOTAL COST	"BEST ESTIMATE" TOTAL COST
On-site Deposition with Cap/Cover	$13,248,000	$21,600,000	$17,424,000

Estimated Low and High Remediation Costs for Miscellaneous Small Remediation Units

RU TYPE	LOW RANGE TOTAL COST	HIGH RANGE TOTAL COST	"BEST ESTIMATE" TOTAL COST
Similar Mixtures	$ 63,370	$ 63,926	$ 68,833
Similar Deposition	$ 63,370	$ 63,926	$ 68,833
Single Contaminant	$ 63,370	$ 63,926	$ 68,833
"Hot Spots"	$ 636,965	$ 642,550	$ 691,876
Debris	$ 759,684	$ 766,344	$ 825,174
Sequalitchew Creek NGRR	$ 633,704	$ 639,259	$ 688,333
Total	$ 2,220,635	$ 2,240,103	$ 2,411,884

Table 8-2 – Summary of Site Remediation Costs

Item	"Best Estimate" of Cost
Proposed Remediation in FS [(1)]	$ 17,424,000
Miscellaneous Small RUs	$ 2,411,884
Groundwater[(2)]	$ 90,000
Total Cost of Site Remediation	$ 19,925,884

[(1)] Based upon preferred alternative listed in Section 8 and costs in Appendix F
[(2)] Based upon preferred alternative listed in Section 8 and costs listed in Appendix I